WHAT IS CLAIMED IS:

1. An optical signal regenerative repeater comprising:

at least one first optical 3R repeater which receives an optical communication signal pulse, and regenerates said optical communication signal pulse,

wherein said first optical 3R repeater comprises

a first clock extraction unit which extracts a clock from said optical communication signal pulse and which generates a first optical clock pulse synchronized with said extracted clock, and

a first optical gate, which is opened and closed in accordance with a control light corresponding to said optical communication signal pulse, which receives as a controlled light said first optical clock pulse generated by said first clock extraction unit, and which generates a first regenerated signal pulse corresponding to said optical communication signal pulse, and

wherein a pulse time width of said control light and said controlled light is different.

2. The optical signal regenerative repeater according to claim 1,

wherein said pulse time width of said controlled light is smaller than said pulse time width of said control light.

3. The optical signal regenerative repeater according to claim 1,

wherein said pulse time width of said control light is smaller than said pulse time width of said controlled light.

4. The optical signal regenerative repeater according to claim 1, further comprising:

a second optical 3R repeater which receives said first regenerated signal pulse output by said first optical 3R repeater as an intermediate signal light, and regenerates said optical communication signal pulse based on said intermediate signal light.

5. The optical signal regenerative repeater according to claim 4,

wherein said second optical 3R repeater comprises

a second clock extraction unit, which extracts a clock from said intermediate signal light and generates a second optical clock pulse synchronized with said extracted clock and having a proper pulse time width; and

a second optical gate, which is opened and closed in accordance with said intermediate signal light, which receives as a controlled light said second optical clock pulse generated by said second clock extraction unit, and which generates a second regenerated signal pulse corresponding to said communication signal pulse.

6. The optical signal regenerative repeater according to claim 5,

wherein said proper pulse time width of said second optical clock pulse and a pulse time width of said optical communication signal pulse input to said first optical 3R repeater are substantially the same.

7. An optical signal regenerative repeater according to claim 5,

further comprising a pulse width converter which converts said pulse time width of said second regenerated signal pulse into said proper pulse time width,

wherein said proper pulse time width of said second optical clock pulse and said pulse time width of said intermediate signal light are substantially the same.

8. The optical signal regenerative repeater according to claim 7,

wherein said pulse time width of said second regenerated signal pulse converted by said pulse width converter and said pulse time width of said optical communication signal pulse are substantially the same.

9. The optical signal regenerative repeater according to claim 4,

wherein said second optical 3R repeater comprises

a second clock extraction unit, which extracts a clock from said first optical clock pulse generated by said first clock extraction unit, and which generates a second optical clock pulse synchronized with said extracted clock; and

a second optical gate, which is opened and closed in accordance with said intermediate signal light, which receives as a controlled light said second optical clock pulse generated by said second clock extraction unit, and which generates a second regenerated signal pulse corresponding to said communication signal pulse.

10. The optical signal regenerative repeater according to claim 9,

wherein said pulse time width of said controlled light supplied to said second optical gate is substantially the same to said pulse time width of said optical communication signal pulse.

11. The optical signal regenerative repeater according to claim 4,

wherein said second optical 3R repeater comprises

a pulse width converter which converts said first optical clock pulse generated by said first clock extraction unit into a proper pulse time width; and

a second optical gate, which is opened and closed in accordance with said intermediate signal light, which receives as a controlled light said first optical clock pulse converted by said pulse width converter, and which generates a second regenerated signal pulse corresponding to said communication signal pulse according to said controlled light received by said second optical gate.

12. The optical signal regenerative repeater according to claim 11,

wherein said pulse time width of said controlled light received by said second optical gate is substantially the same to said pulse time width of said optical communication signal pulse.

13. The optical signal regenerative repeater according to claim 11, further comprising:

a wavelength converter which converts into an arbitrary wavelength a wavelength of said first optical clock pulse generated by said first clock extraction unit.

14. The optical signal regenerative repeater according to claim 1, further comprising:

a wavelength converter which converts into an arbitrary wavelength a wavelength of said first optical clock pulse generated by said first clock extraction unit.

15. The optical signal regenerative repeater according to claim 4,

wherein said second optical 3R repeater comprises

a second optical gate, which is opened and closed in accordance with said intermediate signal light, which receives as a controlled light said first optical clock pulse generated by said first clock extraction unit, and which generates a second regenerated signal pulse corresponding to said communication signal pulse according to said controlled light received by said second optical gate; and

a pulse width converter, which converts into a proper pulse time width a pulse time width of said second regenerated signal pulse generated by said second optical gate.

16. The optical signal regenerative repeater according to claim 15, further comprising:

a wavelength converter, which converts into an arbitrary wavelength a wavelength of said first optical clock pulse generated by said first clock extraction unit.

17. The optical signal regenerative repeater according to claim 1, further comprising:

a pulse width converter which converts into a proper pulse time width a pulse time width of said first regenerated signal pulse output by said first optical 3R repeater.

18. The optical signal regenerative repeater according to claim 17, further comprising:

a wavelength converter which converts into an arbitrary wavelength a wavelength of said optical communication signal pulse supplied to said first optical 3R repeater or a wavelength of said first regenerated signal pulse supplied to said pulse width converter.

19. The optical signal regenerative repeater according to claim 1, further comprising:

a pulse width converter which converts into a proper pulse width a pulse time width of said optical communication signal pulse,

wherein said optical communication signal pulse converted by said pulse width converter is supplied as said control light to said first optical gate.

20. The optical signal regenerative repeater according to claim 19, further comprising:

a wavelength converter which converts into an arbitrary wavelength a wavelength of said optical communication signal pulse supplied to said pulse width converter or said first optical 3R repeater, or a wavelength of said first regenerated signal pulse output from said first optical 3R repeater.

21. An optical gate control method comprising:

supplying to a nonlinear optical phase shifter controlled light having a first pulse time width; and

supplying to said nonlinear optical phase shifter control light having a second pulse time width to generate a nonlinear optical phase shift in a pulse of said controlled light,

wherein said first pulse time width and said second pulse time widths are different.

22. An optical signal regeneration method comprising:

receiving an optical communication signal pulse;

extracting a clock from said optical communication signal pulse and generating a first optical clock pulse synchronized with said extracted clock;

supplying said optical communication signal pulse as a control light to a first optical gate to open or close said first optical gate;

supplying said first optical clock pulse as a controlled light to said first optical gate; and

employing said controlled light to obtain a first regenerated signal pulse corresponding to said optical communication signal pulse according to opening or closing of said first optical gate,

wherein a pulse time width of said control light and said controlled light is different.

23. The optical signal regeneration method according to claim 22,

wherein said pulse time width of said controlled light is smaller than said pulse time width of said control light.

24. The optical signal regeneration method according to claim 22,

wherein than said pulse time width of said control light is smaller than said pulse time width of said controlled light.

25. The optical signal regeneration method according to claim 22, further comprising:

extracting a clock from said first regenerated signal pulse and generating a second optical clock pulse synchronized with said extracted clock from said first regenerated signal and having a proper pulse time width;

supplying said first regenerated signal as a control light to a second optical gate to open or close said second optical gate; and

supplying said second optical clock pulse generated as a controlled light to said second optical gate; and

employing said controlled light supplied to said second optical gate to obtain a second regenerated signal pulse corresponding to said optical communication signal pulse according to opening or closing said second optical gate based on said first generated optical signal pulse.

26. The optical signal regeneration method according to claim 25, further comprising:

converting into a proper pulse time width a pulse time width of said second regenerated signal pulse.

27. The optical signal regeneration method according to claim 22, further comprising:

extracting a clock from said first clock optical signal pulse and generating a second optical clock pulse synchronized with said extracted clock and having a proper pulse time width;

supplying said first regenerated signal pulse as a control light to a second optical gate for opening or closing said second optical gate;

supplying said second optical clock pulse as a controlled light to said second optical gate; and

employing said controlled signal supplied to said second optical gate to obtain a second regenerated signal pulse corresponding to said optical communication signal pulse according to opening or closing of said second optical gate based on said first regenerated signal pulse.

28. The optical signal regeneration method according to claim 22, further comprising:

converting, into a proper pulse time width, a pulse time width of said first optical clock pulse;

supplying said first regenerated signal pulse as a control light to a second optical gate for opening or closing said second optical gate;

supplying said first optical clock pulse, for which said pulse time width is changed, as a controlled light to said second optical gate; and

employing said controlled light supplied to said second optical gate to obtain a second regenerated signal pulse corresponding to said optical communication signal pulse received according to opening or closing of said second optical gate based on said first regenerated signal pulse.

29. The optical signal regeneration method according to claim 22, further comprising:

supplying said first regenerated signal pulse as a control light to a second optical gate to open or close said second optical gate;

supplying said first optical clock pulse as a controlled light to said second optical gate;

employing said controlled light supplied to said second optical gate to obtain a second regenerated signal pulse corresponding to said optical communication signal pulse according to opening or closing of said second optical gate based on said first regenerated signal pulse; and

converting into a proper pulse time width a pulse time width of said second regenerated signal pulse.

30. The optical signal regeneration method according to claim 28, further comprising:

converting into an arbitrary wavelength a wavelength of said first optical clock pulse.

31. The optical signal regeneration method according to claim 29, further comprising:

converting into an arbitrary wavelength a wavelength of said first optical clock pulse.

32. The optical signal regeneration method according to claim 22, further comprising:

converting into a proper pulse time width a pulse time width of said first regenerated signal pulse.

33. The optical signal regeneration method according to claim 32, further comprising:

converting into an arbitrary wavelength a wavelength of said optical communication signal pulse supplied to said first optical gate or a wavelength of said first regenerated signal pulse.

34. The optical signal regeneration method according to claim 22, further comprising:

converting into a proper pulse width a pulse time width of said optical communication signal pulse supplied to said first optical gate.

35. The optical signal regeneration method according to claim 34, further comprising:

converting into an arbitrary wavelength a wavelength of said optical communication signal pulse supplied to said first optical gate or a wavelength of said first regenerated signal pulse.